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Our Ref. No.: NSC1P225R/P03405D1-R1

Re: U.S. Patent Application No. 10/044,162
Filed: January 11, 2002
Title: PLASTIC PACKAGE WITH EXPOSED DIE AND METHOD OF
MAKING SAME

Pages Including Cover Sheet(s): 10

MESSAGE:

Please file the attached Reply Brief in Response to Examiner's Answer in the referenced matter.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Mostafazadeh et al.

Attorney Docket No.:

NSC1P225R/P03405D1-R1

Application No.: 10/044,162

Examiner: Pham, Thanh V.

Filed: January 11, 2002

Group: 2823

Title: PLASTIC PACKAGE WITH EXPOSED DIE
AND METHOD OF MAKING SAME

Confirmation No.: 3102

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Sue Funchess

**TRANSMITTAL OF REPLY BRIEF
IN RESPONSE TO EXAMINER'S ANSWER**

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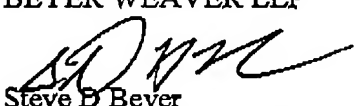
Sir:

Transmitted herewith is the Reply Brief In Response To Examiner's Answer mailed March 29, 2007.

This reply brief is being filed within two (2) months of the mailing date of the Examiner's Answer.

☒ Charge any additional fees or credit any overpayment to Deposit Account No. 500388, (Order No. NSC1P225R).

Respectfully submitted,
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PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE
THE BOARD OF APPEALS**

EX PARTE MOSTAFAZADEH et. al.

Application for Patent

Filed January 11, 2002

Serial No. 10/044,162

FOR:

**PLASTIC PACKAGE WITH EXPOSED DIE AND METHOD OF MAKING
SAME**

REPLY BRIEF

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Sue Funchess
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**BEYER WEAVER LLP
Attorneys for Applicant**

The Examiner's Answer asserts that two different combinations of the Lin and Ogawa references would render the various claims of the present application as obvious. It is believed that neither of these two combinations support a proper 103 rejection and that accordingly, the outstanding rejections should be withdrawn.

Use of the Ogawa Lead Frame with the Method disclosed by Lin

The outstanding rejection initially asserts that it would have been obvious to utilize the lead frame described by Ogawa in the method described by Lin. (See the 1st paragraph of page 6 of the Examiner's Answer). The rational given for this combination is that "the lead frame of Ogawa et al. would provide the formed package of Lin et al with the die being hold (*sic*) during electrical connection and a **thinner thickness product**." It is respectfully submitted that this stated rational is erroneous as a statement of fact and that Lin expressly teaches away from such a combination. Accordingly, it is respectfully submitted that this rejection should be reversed.

The Lin reference describes a system where a very thin pattern of traces 12 are formed on a transfer film 12. Lin states that:

The pattern of conductive traces can be formed in a number of different ways. In accordance with a preferred embodiment of the invention, a foil of conductive material such as copper is laminated to the transfer film and is subsequently patterned using conventional photolithographic patterning and etching. Alternatively, the pattern of conductive traces can be formed, for example, by evaporating a layer of metal or other conductor onto the surface of the transfer film and then patterning that evaporated layer. . . .

Thus, the primary described embodiments contemplate the use of a very thin layer of metal on the transfer film. Importantly, those of ordinary skill in the art would recognize that the proposed foil or evaporatively deposited conductive layers would be expected to be substantially thinner than conventional lead frames. Indeed Lin expressly articulates this advantage when he states at Col. 3, lines 56-58 that: "No thick device 'header' or leadframe is necessary for mounting the device die, and so the thickness "t" is minimized." (*emphasis ours*). Thus Lin expressly teaches away from the use of a lead frame in combination with his invention. Since Lin expressly teaches away from the use of a lead frame in his process, it is respectfully submitted that those of ordinary skill in the art would not be motivated to utilize any lead frame in the Lin process, including the lead frame of Ogawa.

Furthermore, the outstanding office action takes the position that one would want to use the lead frame to create a "thinner thickness product." It is suspected that the Examiner's theory is that the resulting package would be thinner because there is no metal under the die. However, leadframes are generally known to be substantially thicker than the foils and evaporatively deposited layers tend to be even thinner. Since leadframes are typically substantially thicker than the foils taught by the Lin reference, the height of the leads in the hypothetical combination of the Ogawa lead frame on the Lin transfer film would presumably be much higher than the height of the disclosed foil traces. As would be appreciated by those familiar with the art, the design rules that dictate the loop height of the bonding wires are affected by a number of considerations including the height of the die and the height of the trace/lead/contact that is being coupled to. Therefore, it is certainly not clear to the undersigned, and it is believed that it would not be clear to those of ordinary skill in the art, that the substitution of a thicker lead frame that does not include a die attach pad for the thin traces disclosed by Lin would result in an appreciably thinner package overall.

But again, regardless of whether one could, in hindsight, conceive of a way to create an overall thinner package using Lin's process with a lead frame that does not include a die pad, it is respectfully submitted that there is nothing in either the Lin or Ogawa references, or the general knowledge of the art at the time that would suggest the proposed combination. Particularly in view of the fact that Lin specifically touts an advantage of his design as not requiring the use of a lead frame.

The Examiner's answer seeks to address the Applicant's arguments in the Response to Argument section located at pages 8-11 of the Examiner's answer. In the last paragraph of page 8 of the Examiner's Answer, the Examiner appears to take the position that Lin teaches the use of a lead frame.¹ However, neither the final rejection nor the Examiner's answer point to any specific disclosure in Lin that teaches the use of a lead frame. It is noted that at Col. 2, lines 52-54, Lin teaches that "in yet another embodiment, a pattern of traces is formed from a thin sheet of metal and that pattern of traces is then laminated to the transfer film." It is pointed out that although lead frames are formed from relatively thin (e.g. 6 mil) strips of metal, NOT all metal sheets are lead frames and there is nothing in the disclosure of the Lin reference that suggests that Lin intended the term "thin meal sheet" to mean a lead frame. Mr. Lin is a well respected expert in the packaging field who clearly understands the meaning of the term lead frame and the fact that he uses the term lead frame when it was intended (e.g. at Col. 3, lines 56) and not in the cited section of Col. 2 makes

¹ Specifically, the Examiner's Answer states that "This argument is respectfully traversed because, although not taught as a preferred embodiment, Lin teaches this embodiment nonetheless..."

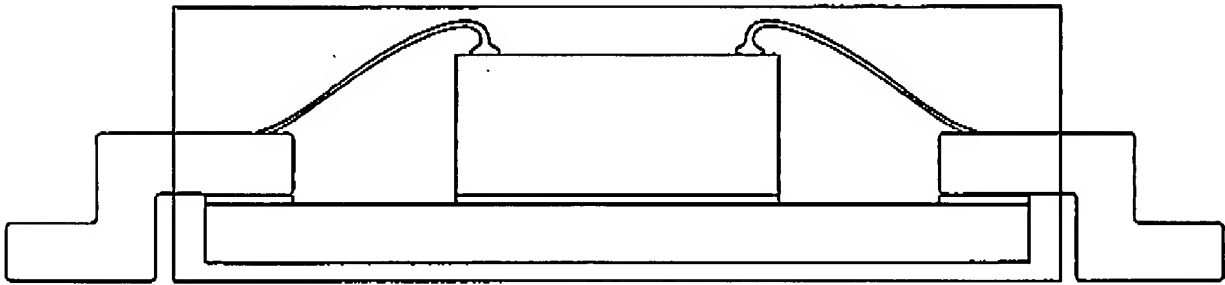
it clear that the cited passage at Col. 2, lines 52-54 was not intended to refer to lead frames. Therefore, it is respectfully submitted that the Examiner's suggestion that Lin teaches the use of a lead frame is clear and reversible error.

In the response to Arguments section of the Examiner's Answer the Examiner cites Celeritas Technologies for the proposition that prior art may anticipate the claims even though it teaches away from the claimed invention. (See page 9, lines 2-3 of the Examiner's Answer) Applicant does not dispute this "rule of law." However, it is believed that that rule is not relevant to the present case because the outstanding rejection is based on an allegation of obviousness as opposed to anticipation. It is respectfully submitted that the fact that a reference explicitly teaches away from a proposed combination is very relevant to a determination of obviousness and the motivation to combine references as part of an obviousness determination.

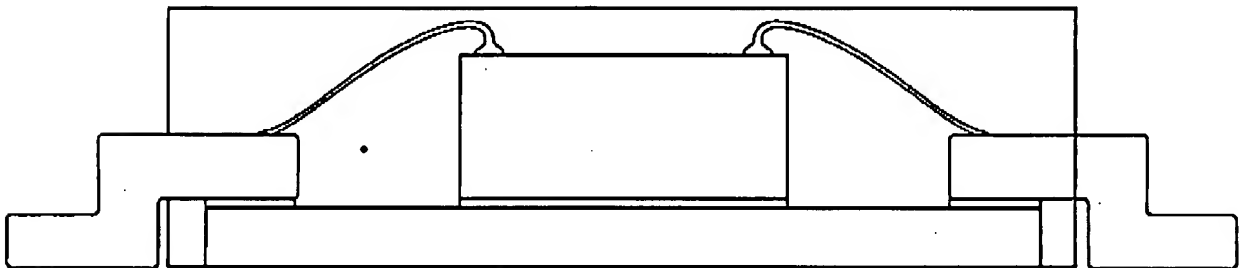
The Examiner's Apparent Misunderstanding of the Ogawa Reference

One area of significant dispute between the Applicant and the Examiner appears to be in the teaching of the Ogawa reference. Applicant readily acknowledges that Ogawa teaches a lead frame having a central opening and that such a metallic lead frame, standing alone (i.e., without the resin film 2) is highly analogous to the metal lead frame used in the present application. Further, applicant points out that prior to Applicant's invention there were a wide variety of packaging designs that used lead frames with central openings. Where Applicant and the Examiner appear to disagree significantly is on how a person of ordinary would interpret and understand the teaching of Ogawa.

At the time of Ogawa's invention, as well as at the time of the present invention, lead frames having central openings were well known. Typically, when such lead frames were used in wire bonded, plastic molded semiconductor packages, they were used in conjunction with a permanent die support structure (often a metal heat spreader). It is the undersigned's understanding, and it is believed that those of ordinary skill in the art would clearly understand that the resin film 2 illustrated in Fig. 1 of Ogawa is just such a permanent die support structure (the copper plate 8 illustrated in Fig. 4 of Ogawa is also a permanent die support structure). As was well known by those familiar with the art, such die support structures typically were permanently affixed to the lead frame and became an integral part of the resulting package. Thus, although designs varied, a cross section of the resulting package would typically look something like Figure 1 below.

**FIG. 1**

That is, in some cases, the die support structure would be completely encapsulated by the molding material. In other circumstances, the die support structure would be exposed on the bottom surface of the package. By way of example, a cross sectional view of one such arrangement might look something like Fig. 2 below.

**FIG. 2**

It is the Applicant's understanding that when die support structures of the type disclosed by Ogawa were intended to be used in molded packages, they were traditionally incorporated into the design as illustrated in Figs 1 and 2 above. In at least one of the combinations asserted in the outstanding rejection, the Examiner has taken the position that the resin film 2 in Ogawa is not necessarily incorporated into the package. Specifically, the last paragraph of page 11 of the Examiners Answer states that:

The hypothesis that Ogawa et al.'s tape 2 is . . . a permanent part of the finished package is not correct. The adhesive tape 2 of Figs. 1 and 3 . . . could not be a permanent (sic) as alleged because it is used "as an element-mounting member"

"[o]n account of this, it is apprehended that, due to shear stress to be exerted at the time of bending work of the lead during the assembling step of the semiconductor package."

The undersigned is unable to make sense of the cited passage and further does not understand what in the cited passages causes the Examiner to believe that the resin film 2 is not permanently affixed to both the die and the lead frame.

After asserting that the Applicant's understanding is incorrect, the Examiner appears to reverse his direction. For example, in the first full paragraph of Page 12 of the Examiner's Answer, the Examiner seems to acknowledge that Ogawa's resin member 2 "may be" a permanent structure. However, the Examiner goes on to state that "the rejection is based, not on Ogawa's invention, but on Ogawa recognized known prior art of Fig. 5...". Specifically, the Examiner points to text from the background section of the Ogawa patent that explained that the adhesive force between the metal lead frame 1 and the resin film 2 in the prior art "is not necessarily sufficient." (See Col. 2, lines 15-22 of Ogawa). Thus, the Examiner appears to extrapolate that Ogawa was suggesting the prior art carrier films were intended to be removed. It is respectfully submitted that those of ordinary skill in the art would have a very, very different understanding of the cited section. Specifically, the cited section merely explain that prior adhesives would sometimes allow gaps to form at the adhesive interfaces and that such gaps could facilitate the adsorption of moisture into the resulting packages which can cause reliability problems in the resulting package. It should be apparent to anyone reading the section (and certainly it would be apparent to those of ordinary skill in the art) that such adhesive boundary problems only exist when the adhesive and the resin carrier are incorporated into the final package.² For the board's convenience, the text of the disputed paragraph is reproduced below.

As mentioned above, the conventional lead frame is of such a construction that the resin film 2 is directly joined with the inner lead 1 made of a copper alloy or an iron alloy by means of the resin type adhesive 3. In general, however, the adhesive force between the resin type adhesive agent and these metal materials is not necessarily sufficient. On account of this, it is appreciated that, due to shear stress to be exerted at the time of bending work of the lead during the assembling step of the semiconductor package, or thermal stress to be applied under various heating environments, or else, adhesiveness at the above-mentioned adhesive interface becomes decreased to bring about very fine gaps between them. In such case, when moisture-adsorption takes place in the package, water is condensed in these small gaps, and this condensed water, when heated again, becomes vaporized to expand its

² Of course, moisture penetration is a potential problem at virtually any adhesive boundary of a molded package.

volume to lead to a possible danger of bringing about cracks in the semiconductor package. Therefore, improvement in the adhesive force between the resin member and the metal member is of paramount importance on the operational reliability of the semiconductor package. (*emphasis added*).

It is submitted that this passage makes it clear that Ogawa contemplated that the resin member 2 was to be permanently attached to the lead frame and incorporated into the package in both his own invention and in the prior art to which he was referring. Accordingly, as previously expressed, it is respectfully submitted that removing the resin film would completely defeat the purpose of the Ogawa reference. In view of the foregoing, it is respectfully submitted that the Examiner's suggestion that Ogawa characterizes the prior art resin carriers as being removable is clear and reversible error as well.

Although it should not, in theory, be relevant to the outstanding rejection, it is believed that the portion of the Examiner's Answer that discusses Ogawa's use of a metal plate 8 as a die support structure is highly indicative of his mischaracterization of the art. In the last paragraph that begins on page 11 of the Examiner's answer, the Examiner appears to argue that the metal plate 8 can't possibly be a permanent part of the finished package under the belief that the metal plate would somehow short circuit the leads. It is respectfully submitted that this statement shows a deep misunderstanding of the state of the art at the time of Ogawa. Specifically, in the type of packages shown in Fig. 4 of Ogawa, the electrical insulation between the lead frame and the metal carrier was typically provided, at least in part, by the adhesive (in Ogawa's case, the "resin type adhesive agent 3") that is used to secure these two parts together. In some circumstances, oxidation of the surface of one or both of the metal surfaces provided and/or other insulative layers provided additional insulative protection.

The Reverse Rejection – The Use of a Plastic Casing with the Ogawa Lead Frame

The outstanding rejection also asserts that it would have been obvious to "provide the method of Ogawa et al. with a plastic casing because the plastic casing would provide the process of Ogawa et al with complete [sic] semiconductor package device." See page 6, 2nd paragraph of the Examiner's answer. The Applicant does not dispute that it would be obvious to encapsulate the Ogawa lead frame with a plastic casing. However, Applicant strongly disputes the Examiner's conclusion regarding the appearance of the resulting device. As discussed above, it is believed that when the Ogawa lead frame is incorporated into a molded package, it would typically look like one

of the Figures illustrated above. It is respectfully submitted that nothing in the Lin reference would motivate those skilled in the art to modify Ogawa to remove the resin film and produce the claimed invention because to do so would completely defeat the purpose of the Ogawa reference.

Conclusion

For the reasons set forth in the original Appeal Brief and further in view of the forgoing, it is respectfully submitted that the outstanding rejections of claims 1 and 4-15 should be reversed.

Respectfully submitted,
BEYER WEAVER LLP



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